"Trade Induced Technical Change": Some more details for Interested Readers

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A. Introduction

Our paper "Trade Induced Technical Change: The impact of Chinese imports on Innovation, IT and Productivity" (Nick Bloom, Mirko Draca and John Van Reenen) has generated much discussion since its publication in 2016. There are now a number of papers looking at the impact of Chinese imports (and trade more generally) on innovation. An excellent recent survey and discussion of the literature is in Steinwender and Shu (2018). See also Bloom, Van Reenen and Williams (2019) for a policy-oriented discussion. There has also been a flurry of policy interest in the beneficial impact of trade, given the claims by a number of organizations (e.g. the IMF, ECB and Federal Reserve) that impeding US-China trade is leading to a slowdown in US economic growth and investment.

Many researchers have used the data and asked for more details on its construction, so we have provided some more replication files (Part B). There has also been discussion over the relationship between our results and those in the US by Autor, Dorn, Hansen, Pisano and Shu (ADHPS, 2019), and in the EU by Campbell and Mau (2019).

In Parts C and D, we show some analogous specifications in our data to ADHPS to demonstrate that the difference in results is a substantive one rather than to do with the details of econometric specification. We believe this is most probably due to heterogeneity in the impact of Chinese import competition between the EU and North America.

B. More details on estimation of productivity for replication file

We have updated our replication package available now at https://nbloom.people.stanford.edu/research under "Trade Induced Technical Change: The Impact of Chinese Imports on Innovation, Diffusion and Productivity" updated data. This includes the "back-end" program **prod16d_md_v18.do** that creates the TFP data used in **tfp_assemble_v6.do** that we posted online. **prod16d_md_v18.do** generates alternative TFP measures (the key one we use is the one described in Appendix C, tfp_kg where the suffix "kg" stands for Klette-Griliches).

C. Comparison with Autor, Dorn, Hansen, Pisano and Shu (2019) specification

In an important contribution, ADHPS also analyse the impact of Chinese imports on innovation, but their focus is on US data rather than the European data that we use. In contrast to our paper, they find that Chinese import competition has a negative effect on patenting. There could be many reasons for the different results such as differences in the country setting and data construction and ADHPS discuss some of these. If for example, product market competition in the US economy was more competitive initially than in Europe before the China shock *and* competition and innovation have an "inverse U" relationship (as in Aghion et al, 2005), this could account for the differences between our papers.

Another possibility is that our specifications are different. To investigate this econometric possibility we have implemented analogous specifications to ADHPS in our European data. The results are contained in a follow-up paper with Paul Romer and Stephen Terry available at: http://people.bu.edu/stephent/files/TF_MAIN_DOC.pdf. The relevant part is Table 1 on p. 8. There are three main differences between our baseline approach and that of ADHPS:

(i) Instrumental Variables

ADHPS suggest using the growth of Chinese imports in the same industries in European countries as an IV for the growth of Chinese imports in the US. The analogous specification for us would be to use growth of Chinese imports in the US in the same industry and time period as an instrument for the growth of Chinese imports in Europe. In Bloom, Draca and Van Reenen (2016), our IV strategy focused on using the removal of quotas under the MFA when China entered the WTO. We were concerned that the growth of imports in the US (or other countries) could be correlated with unobserved global technology shocks in these industries, so the IV may not be valid.

(ii) Measure of industry size to normalize Chinese import change.

We want to control for industry size to normalize for Chinese imports and arguments can be made for different normalizations. Our use of total imports in the four-digit sector in our baseline was mainly a pragmatic one, as UN COMTRADE has this variable for all four-digit industry by country by year cells based on high quality and well-measured customs data. An alternative used by Autor et al (2019) is industry production or apparent consumption. In Europe, the PRODCOM data has this information, which is well populated at the three-digit level but has more missing values at the four-digit level that we use in the main analysis. We showed robustness to this normalization as a robustness check in Panel C of Table 1 in the original paper.

(iii) Industry trends

ADHPS emphasize the importance of controlling for pre-existing industry trends. We showed robustness to industry trends in our main paper in Table 1 Panel B, but we also show the robustness to the new specifications here with the alternative normalization by production and the instrumental variable strategy of ADHPS in what follows.

D. Discussion of the New Results

Panel A of Table 1 in Bloom, Romer, Terry and Van Reenen is reproduced below. Column (1) normalizes Chinese imports by production and shows the baseline result of a significant positive association of the growth of firm innovation and the growth of Chinese import intensity in the country-industry pair with a coefficient of 0.095. We use the ADHPS style IV's in column (2). The first stage is strong (F-statistic of 16). In this specification we again obtain a positive and significant coefficient which is about three times as large as the OLS results of the previous column. Column (3) includes industry trends in the specification of column (2). The coefficient on Chinese imports falls to 0.222, but remains significant at the 5% level. Panel B of Table 1 shows the same specifications results using sales as a dependent variable rather than patents.

Table 1: Chinese Import Growth, Patenting and Firm Sales

	(1)	(2)	(3)
	Panel A: Patents		
Estimation Method	OLS	IV	IV
Change in Chinese Imports	0.0952***	0.303***	0.222**
	(0.0310)	(0.0763)	(0.105)
First-Stage F-Statistic		16.1	19.4
Sector Trends			X
Years	1996-2005	1996-2005	1996-2005
Industry-Country Clusters	910	910	910
Firms	7,006	7,006	7,006
Firm-Year Observations	24,926	24,926	24,926
	Panel B: Sales		
Change in Chinese Imports	0.001	-0.473***	-0.631***
	(0.035)	(0.161)	(0.235)
First-Stage F-Statistic		20.1	16.1
Sector Trends			X
Years	1996-2005	1996-2005	1996-2005
Industry-Country Clusters	885	885	885
Firms	6,119	6,119	6,119
Firm-Year Observations	20,722	20,722	20,722

Notes: *** denotes 1%, ** 5%, and * 10% significance. Standard errors clustered by country x 4-digit SIC industry and year (in parentheses). Country-year effects in all models. Firm-level patenting per worker from the European Patent Office. Firm sales from BvD Amadeus. Dependent variables each in five-year percent changes. Chinese import growth in Europe by country-industry-year from UN Comtrade for Austria, Germany, Denmark, Spain, Finland, France, Great Britain, Ireland, Italy, Norway, Sweden. The instrumental variable for all models is Chinese import growth into the US industry-year cell. Trade flows normalized by 1996 production in the country-industry cell, from Eurostat's Prodcom or the NBER manufacturing database. Sectoral trends specifications include 2-digit SIC sector dummies.

Source: Bloom, Romer, Terry and Van Reenen (2019)

E. Conclusions

The robustness of the results suggests that the difference between our results and those of ADHPS is not due to specification differences, but is rather more fundamental due to differences between the US and EU.

References

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